

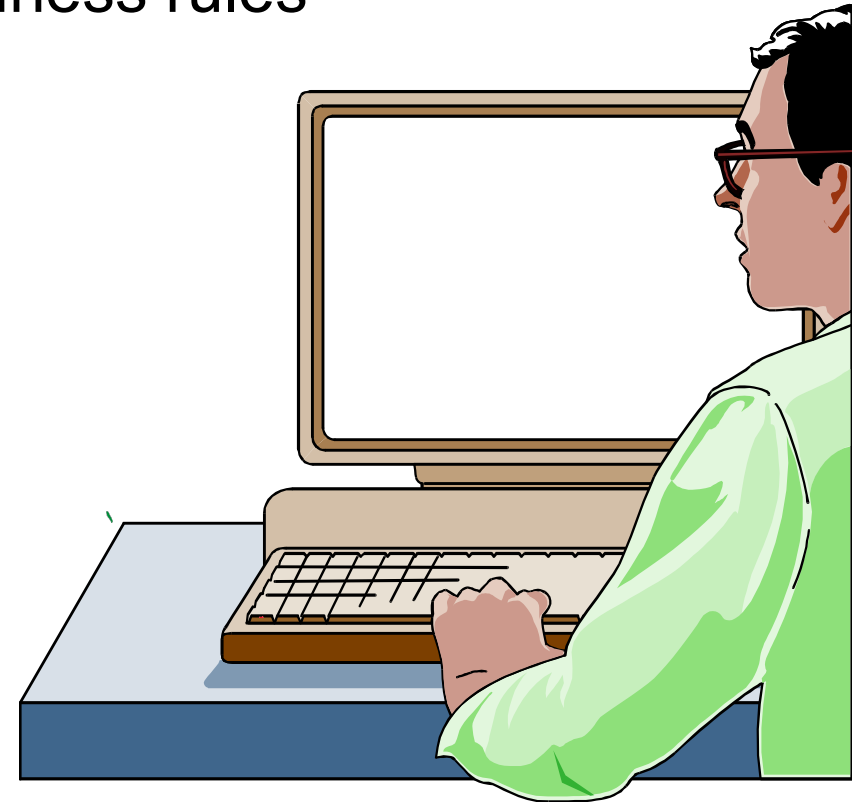
Chapter

The Enhanced ER Model and Business Rules

Enhanced E-R Model

- An E-R model that has been extended to include supertype/subtype relationships and business rules

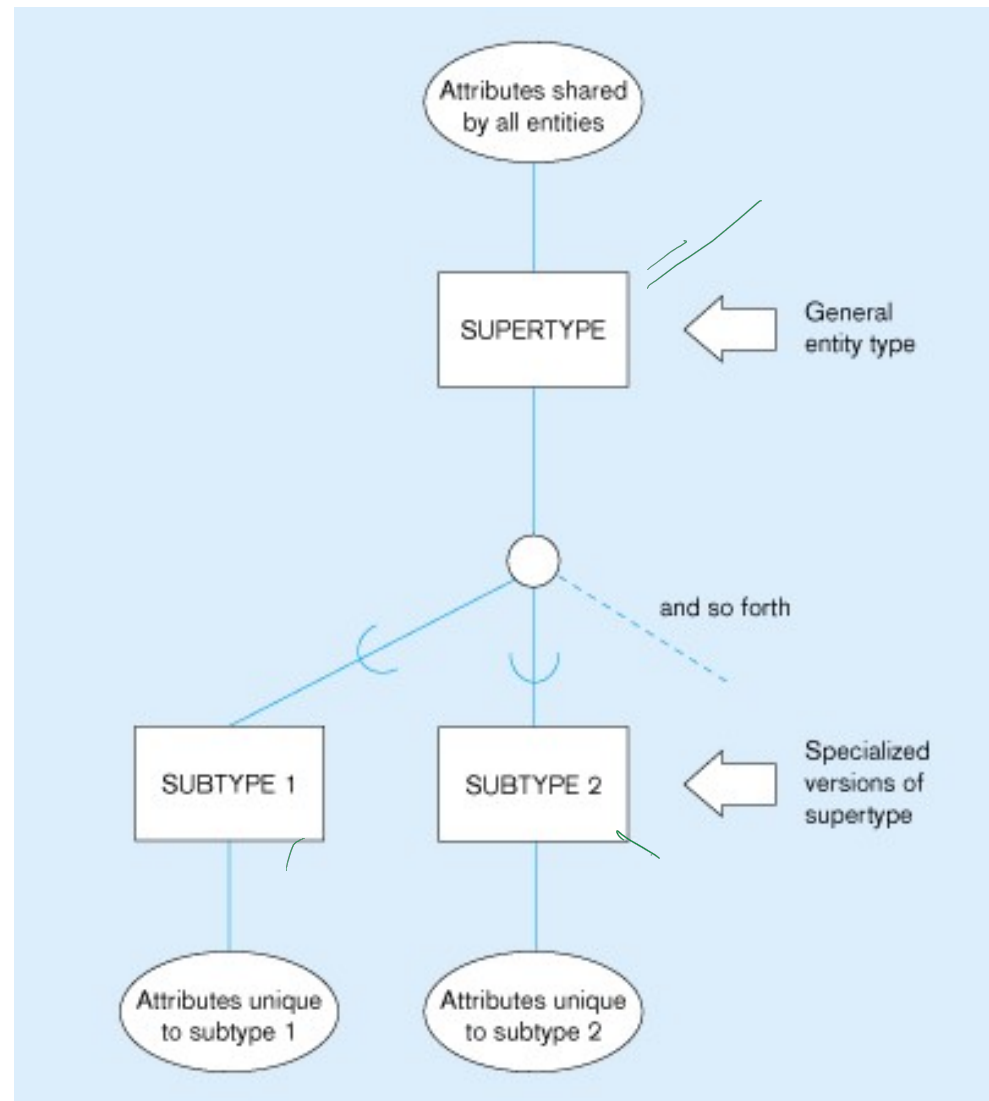
Super type ve sub type içeriyorsa enhanced er



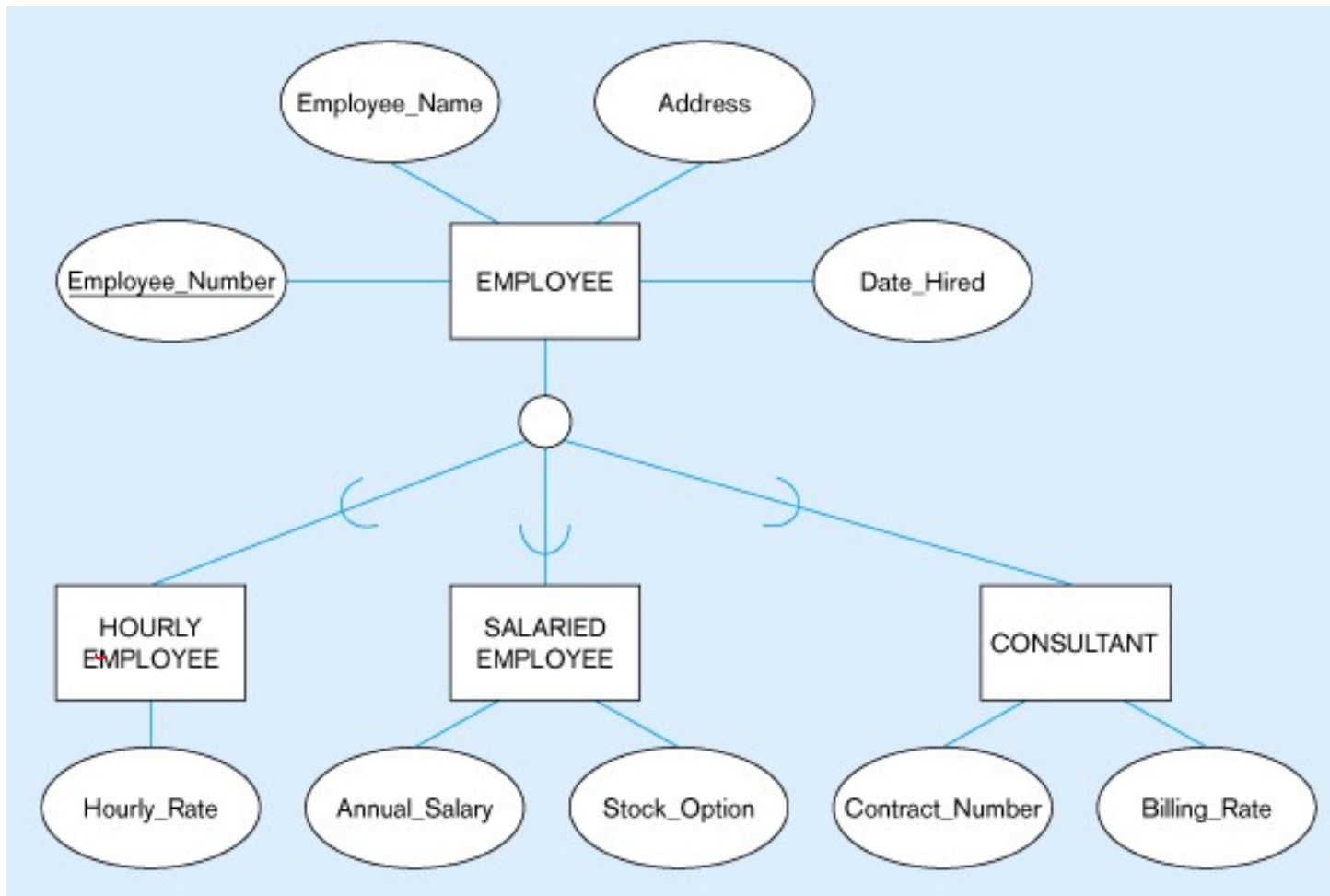
Supertypes and Subtypes

- **Supertype:** A generic entity type that has a relationship with one or more subtypes
- **Subtype:** A subgrouping of the entities in an entity type which has attributes that are distinct from those in other subgroupings
- **Inheritance:**
 - The concept that if an entity is a subtype it retains all the attributes of the supertype
 - Subtype entities inherit values of all attributes of the supertype
 - An instance of a subtype is also an instance of the supertype

Basic notation for supertype/subtype relationships



Employee supertype with three subtypes



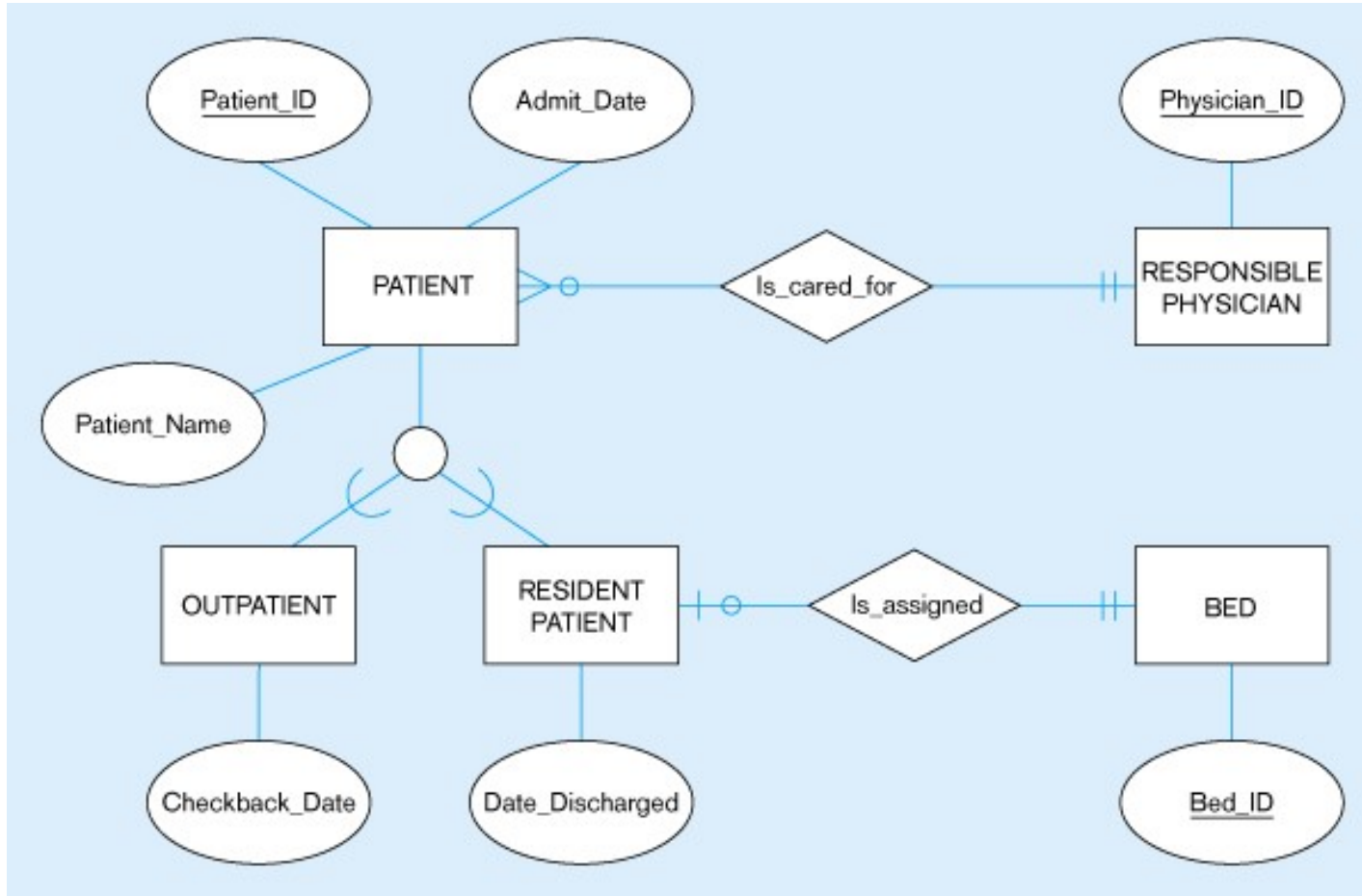
Relationships and Subtypes

- Relationships at the **supertype** level indicate that all subtypes will participate in the relationship
- The instances of a **subtype** may participate in a relationship unique to that subtype. In this situation, the relationship is shown at the subtype level

Relationships:

- 1) Super Type Levelda ise : All subsystems will join.
- 2) Subtype Levelda ise : Only this subtype will join

Supertype/subtype relationships in a hospital



Generalization and Specialization

- **Generalization:** The process of defining a more general entity type from a set of more specialized entity types. BOTTOM-UP
- **Specialization:** The process of defining one or more subtypes of the supertype and forming supertype/subtype relationships. TOP-DOWN

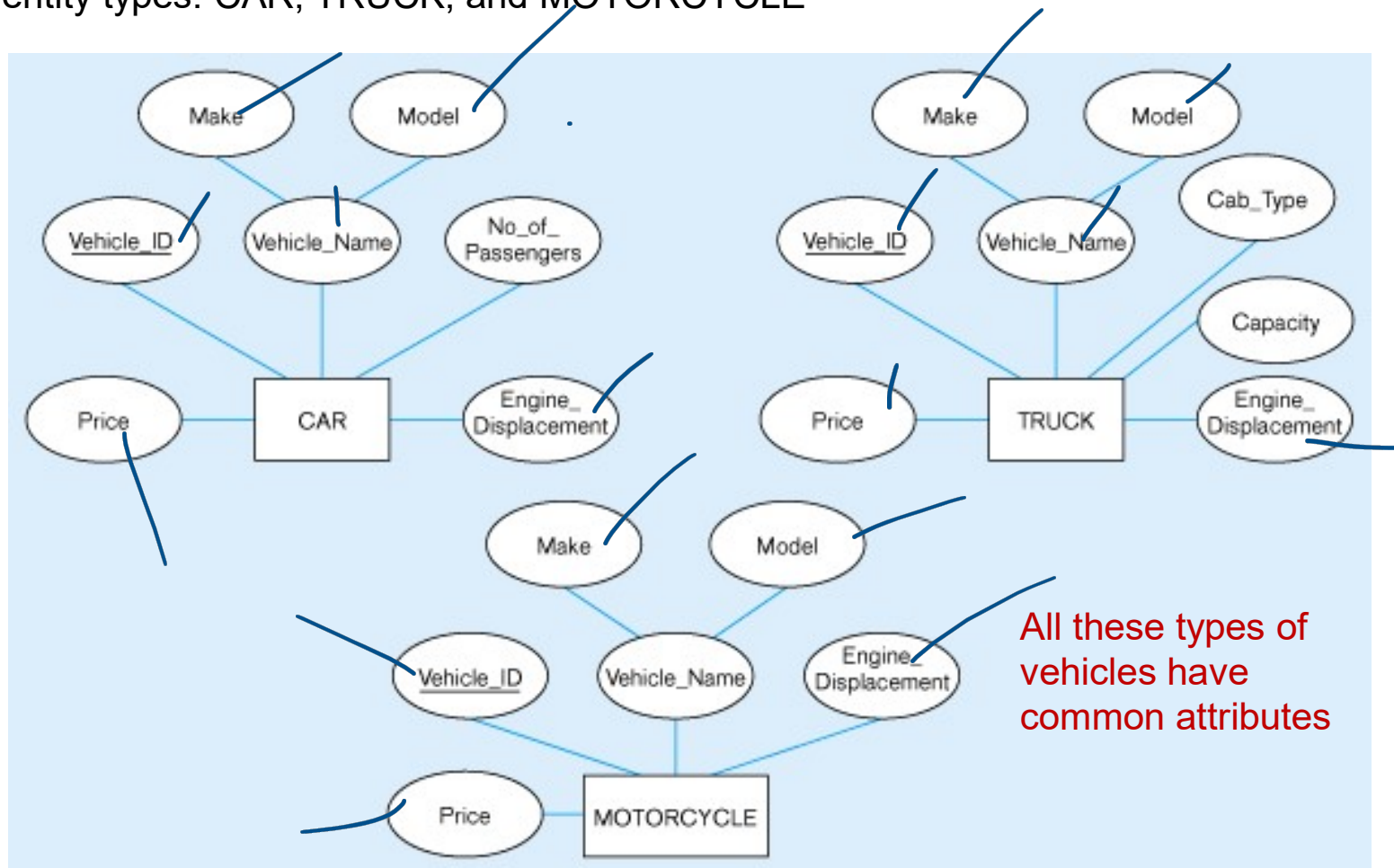
Generalization

- The concept that some entities are subtypes of other more general things
- The process of defining a more general entity from a set of more specialized entity types

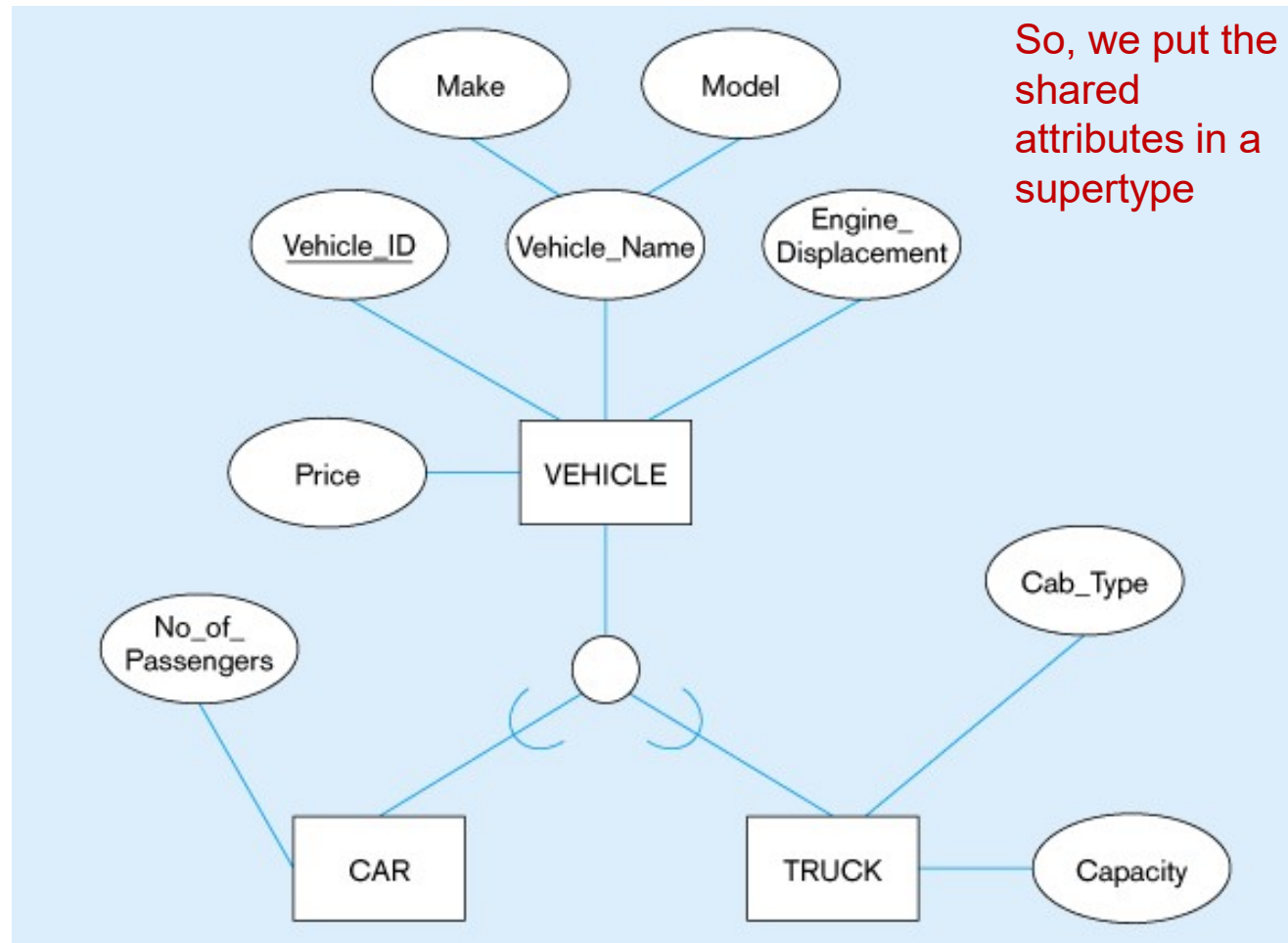
bottom up

Example of generalization

(a) Three entity types: CAR, TRUCK, and MOTORCYCLE



Generalization to VEHICLE supertype

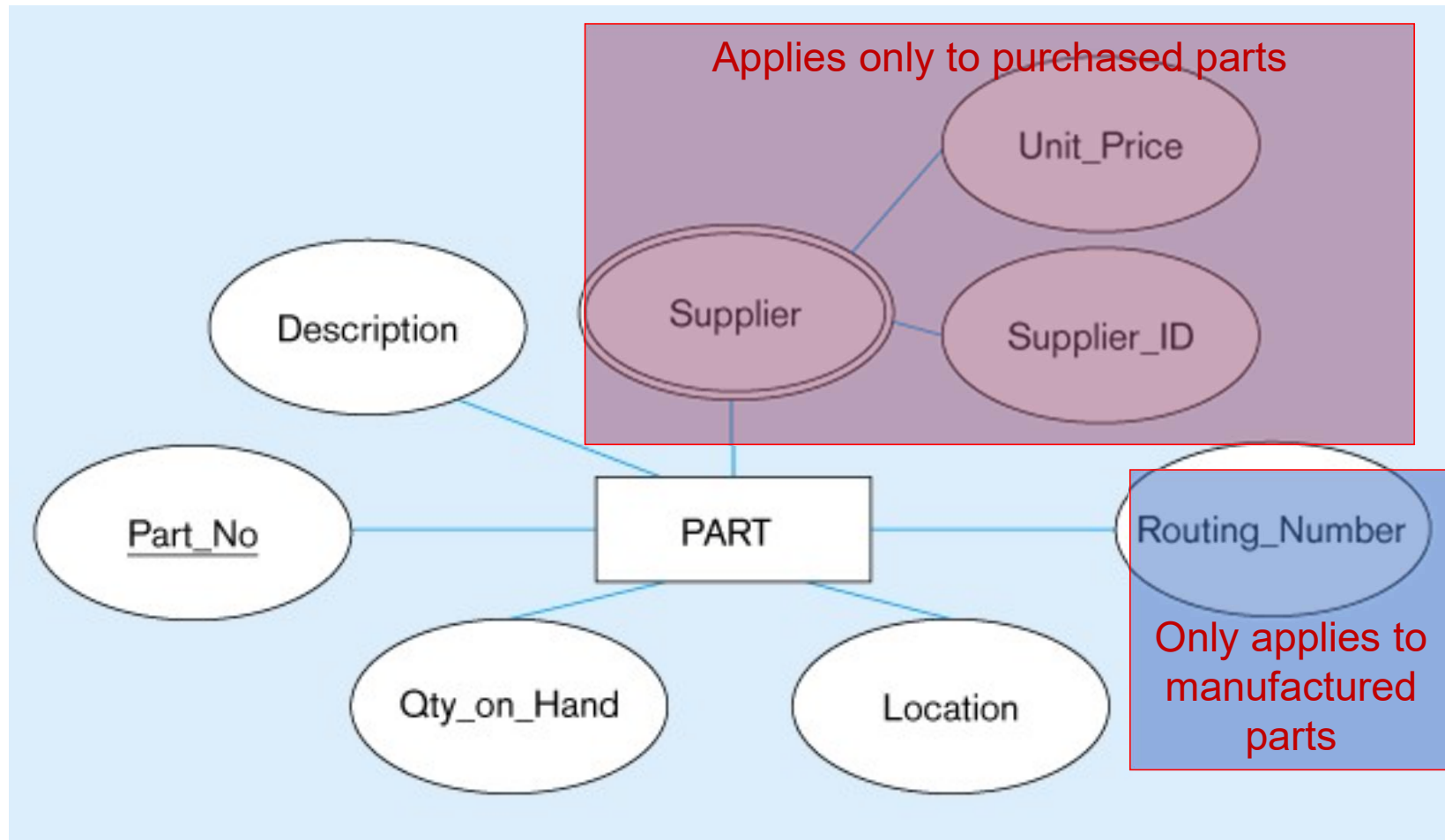


Specialization

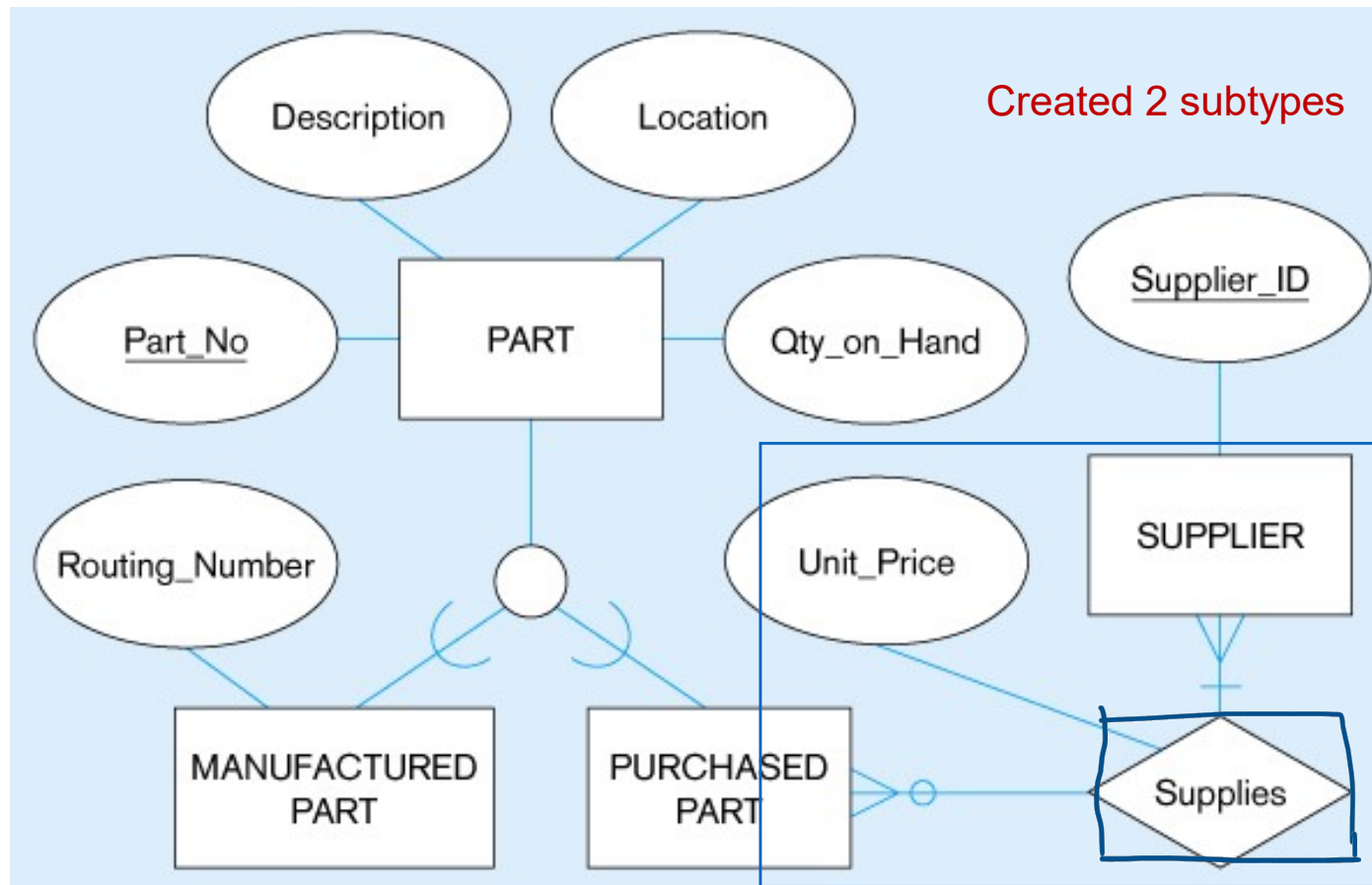
- The concept that an entity comes in various subtypes (opposite of Generalization)
- The process of defining one or more subtypes of the supertype
- EXAMPLES:
 - Ice-cream has several flavors
 - Vanilla, Chocolate, Strawberry, ...
 - Automobiles are of different types
 - Van, Sedan, Pickup, MPV, ...
 - Patients are of different types
 - Outpatient, Resident_Patient

Example of specialization

(a) Entity type PART



Specialization to MANUFACTURED PART and PURCHASED PART



Note: multivalued attribute was replaced by a relationship to another entity

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Constraints in Supertype

- **Completeness Constraints:** Whether an instance of a supertype *must* also be a member of at least one subtype
 - Total Specialization Rule: Yes (double line)
 - Partial Specialization Rule: No (single line)

Total Participation Example: In a university database, if Person is a supertype with subtypes Student and Faculty, applying total specialization means every Person is either a Student or a Faculty (or both, if allowed).

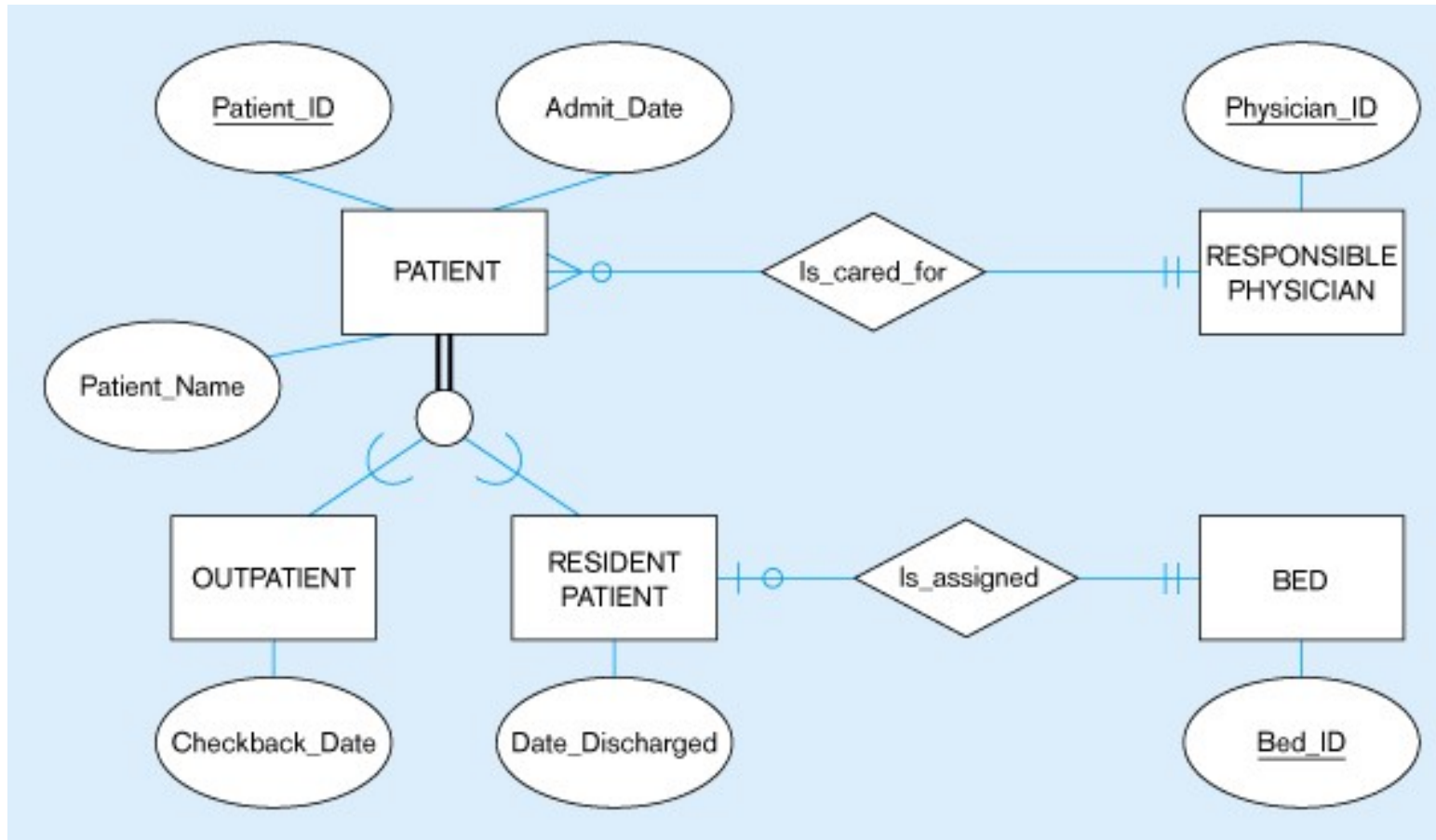
Partial Specialization Example: In a database for vehicles, if Vehicle is a supertype with subtypes Car and Truck, applying partial specialization means that some instances of Vehicle may not fall into either Car or Truck (e.g., a motorcycle).

Total Participation : Supertype'n her bir instance' subtypelardan biri olmal.

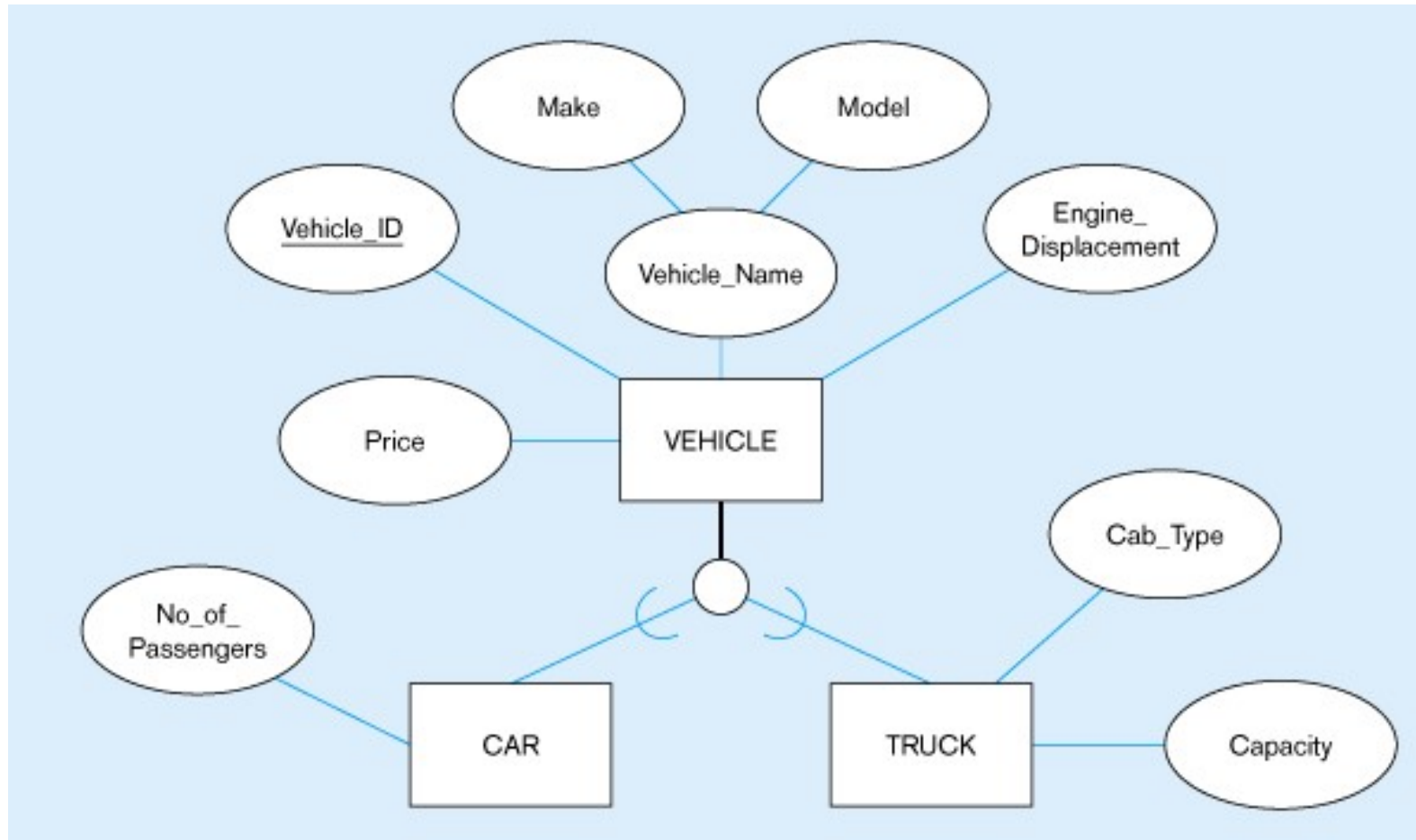
Partial Participation : Supertypelardan her biri subtypelardan biri olmak zorunda deildir.

Examples of completeness constraints

(a) Total specialization rule



(b) Partial specialization rule

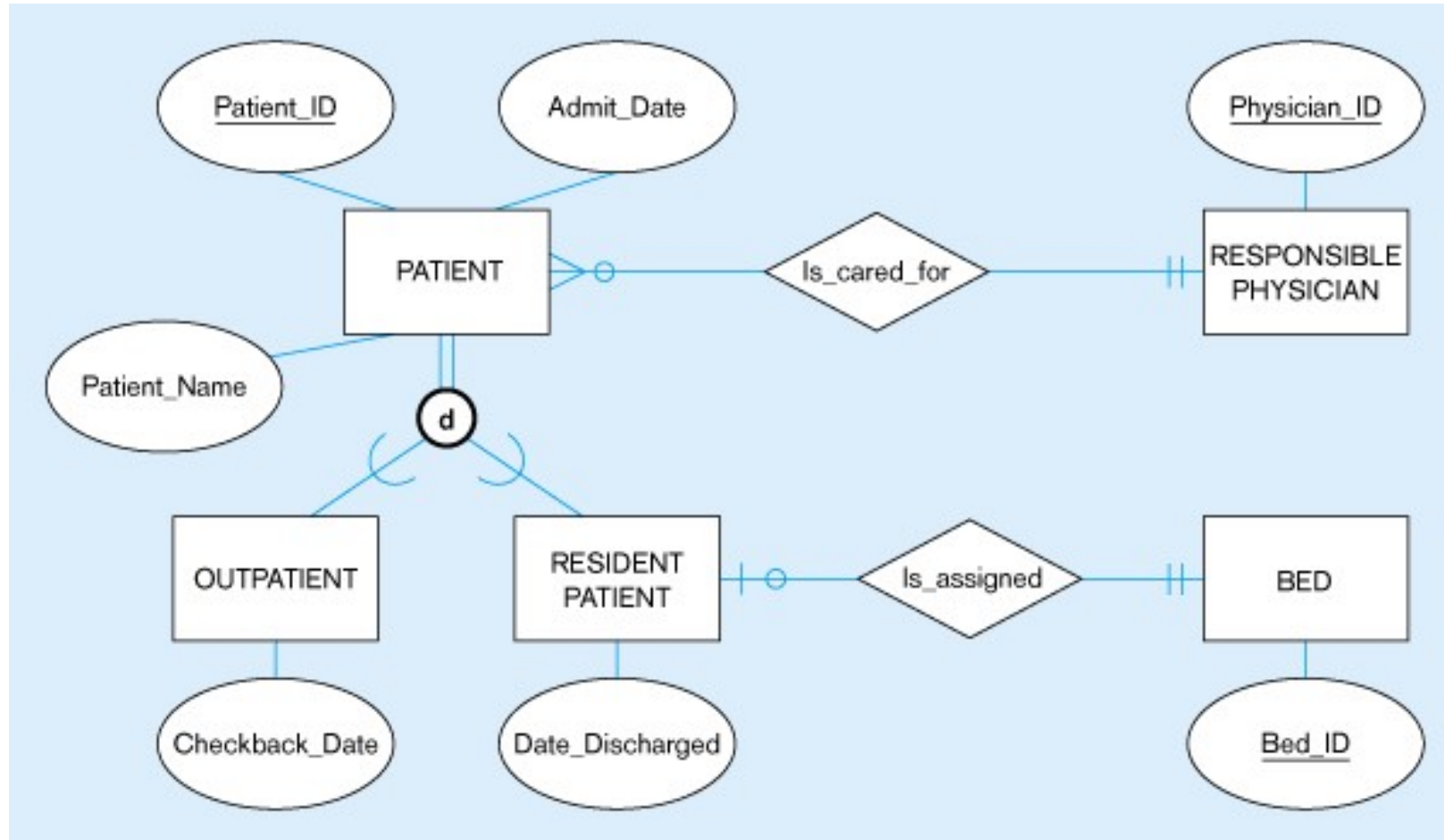


Constraints in Supertype

- **Disjointness Constraints:** Whether an instance of a supertype may *simultaneously* be a member of two (or more) subtypes.
 - **Disjoint Rule:** An instance of the supertype can be only ONE of the subtypes
 - **Overlap Rule:** An instance of the supertype could be more than one of the subtypes

Examples of disjointness constraints

(a) Disjoint rule



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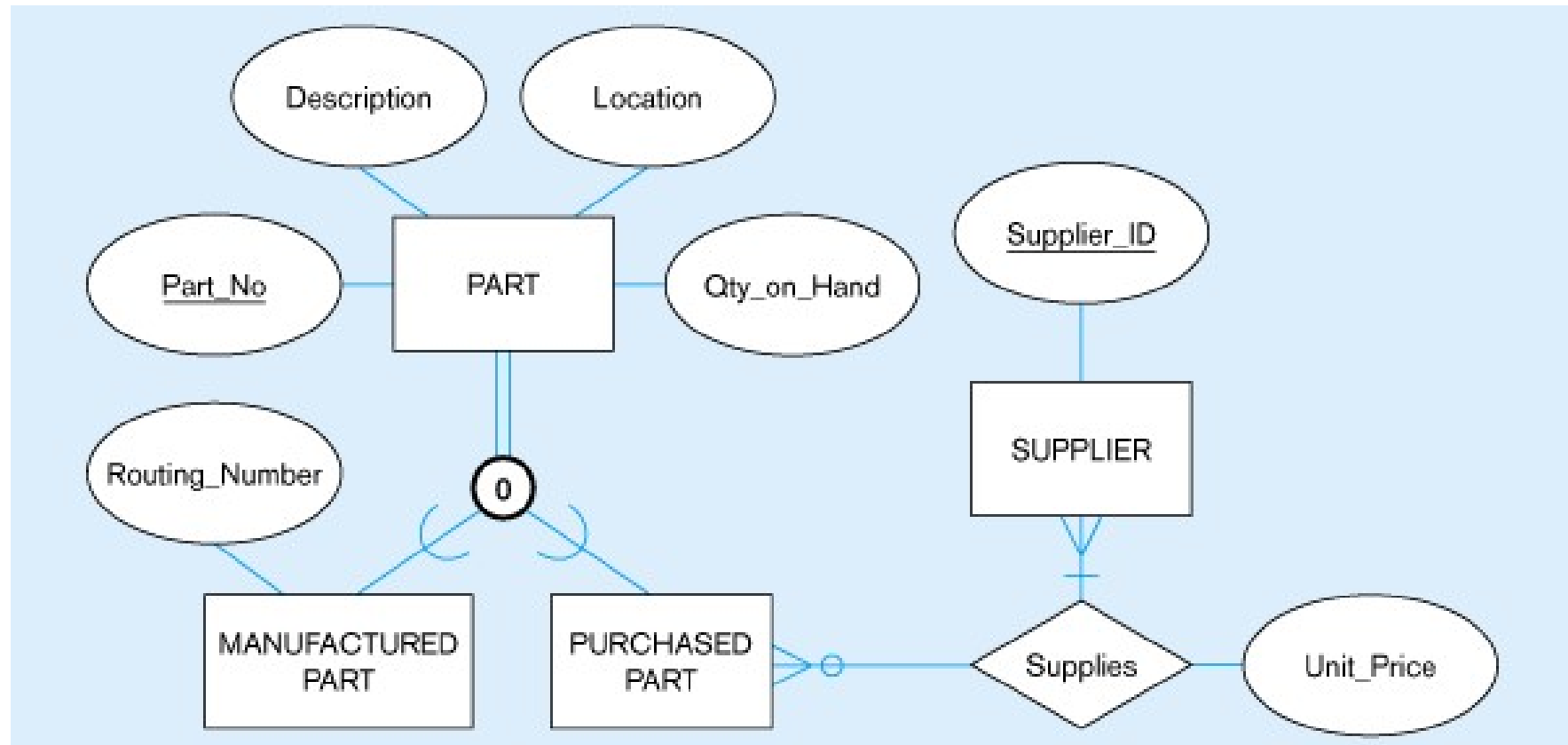
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Mesela burada Patient SUPERTYPE çift ok var total participation var her bir patient instance' outpatient ya da resident olmalı
Aynı zamanda d disjoint rule var yani patient instance ya outpatient ya da resident olabilir ikisi beraber olamaz -> disjoint rule

1) Completeness constraint -> total participation

2) Disjoint Constraint -> disjoint rule

(b) Overlap rule

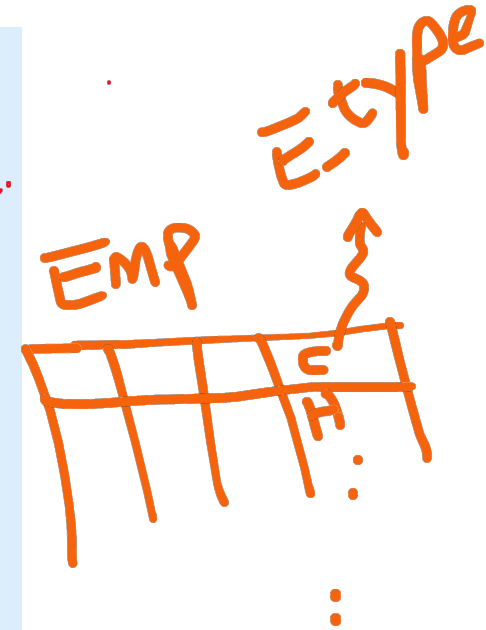
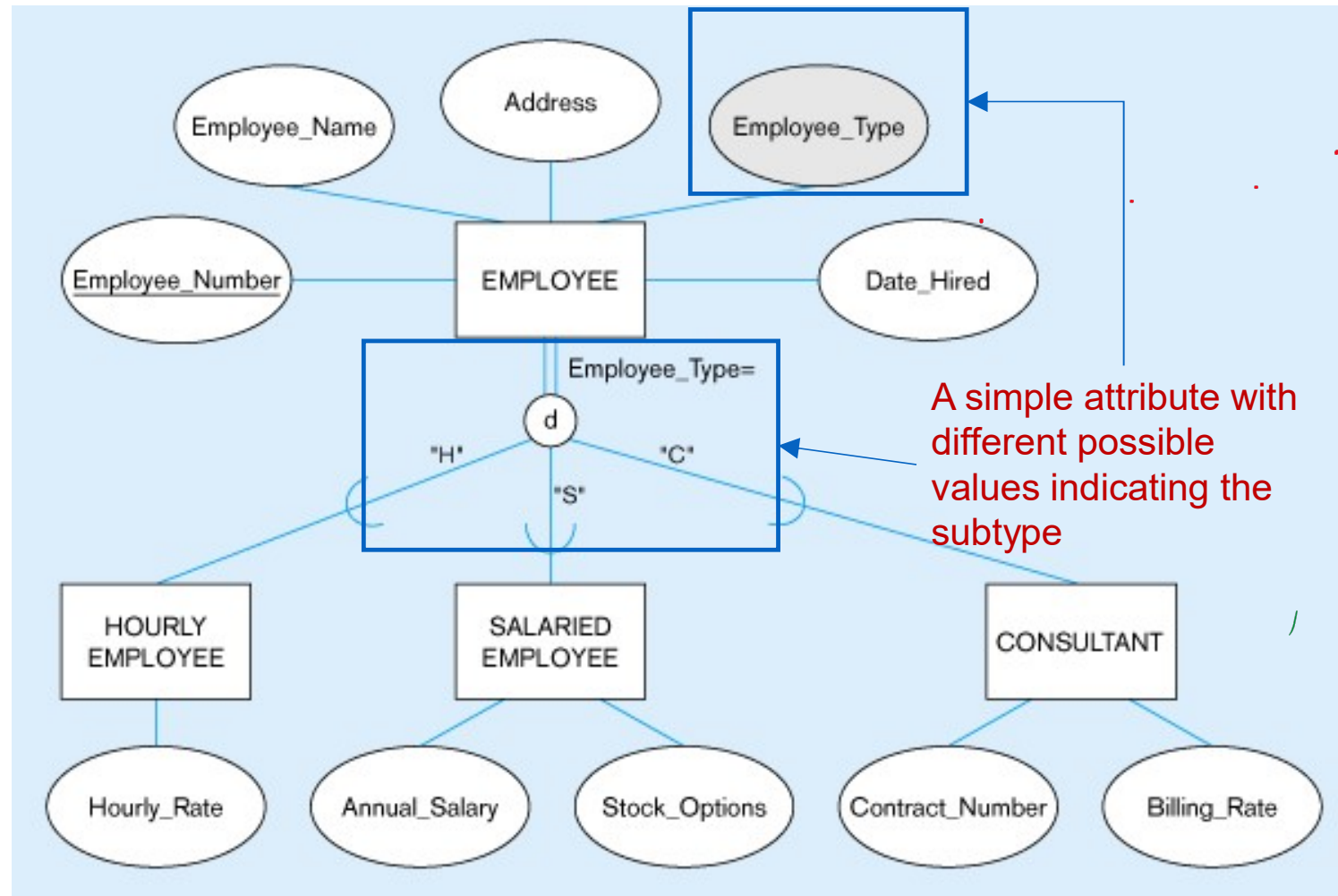


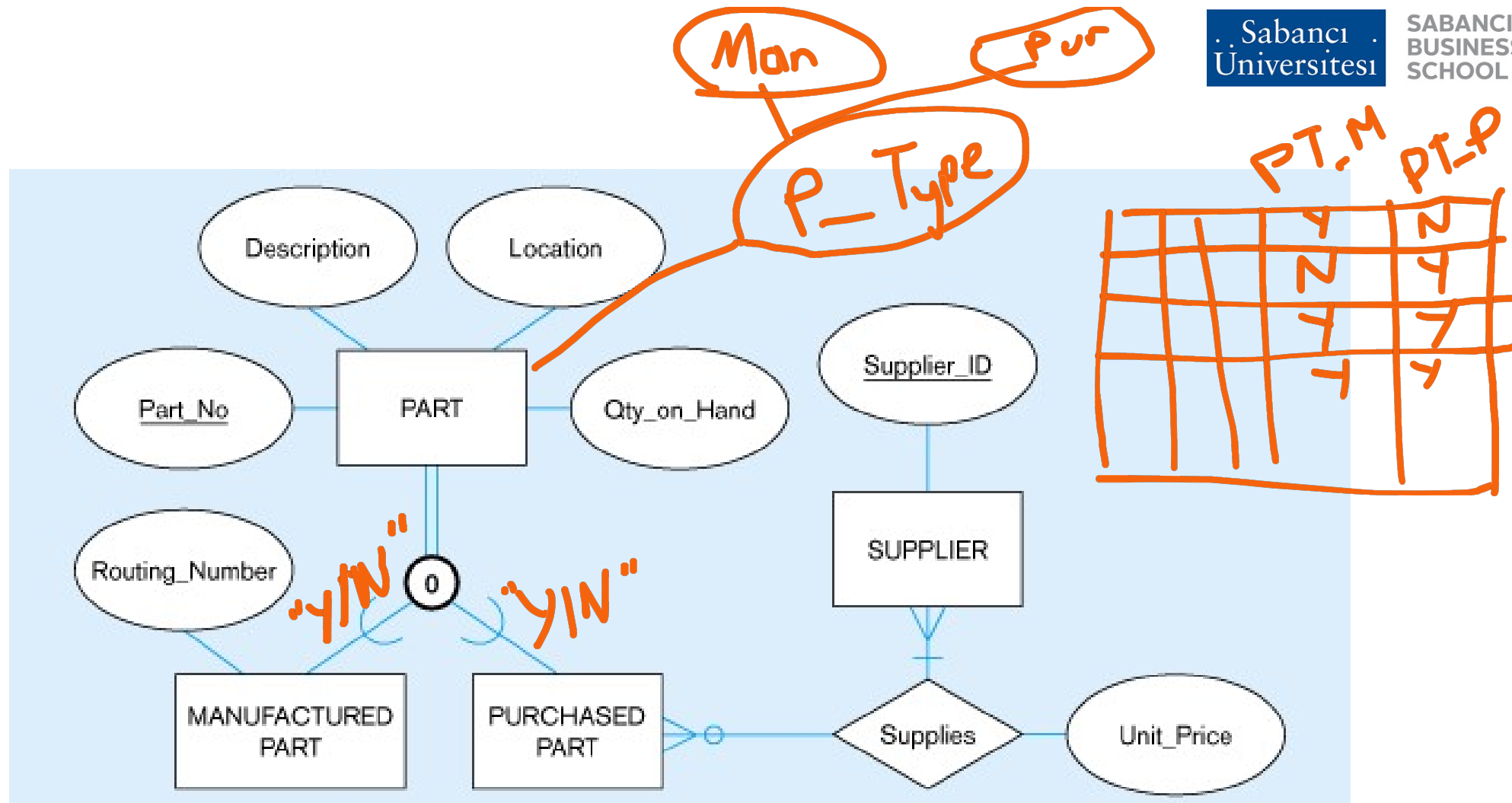
Total participation var çift ok -> Part SUPERTYPE ve her bir instance subtypelardan biri olmalı general bir part olamaz.
O var -> overlap rule yani supertype instance' ayn anda hem purchased part hem de manufactured part olabilir.

Constraints in Supertype

- **Subtype Discriminator:** An attribute of the supertype whose values determine the target subtype(s)
 - **Disjoint** – a *simple* attribute with alternative values to indicate the possible subtypes
 - **Overlapping** – a *composite* attribute whose subparts pertain to different subtypes. Each subpart contains a boolean value to indicate whether or not the instance belongs to the associated subtype

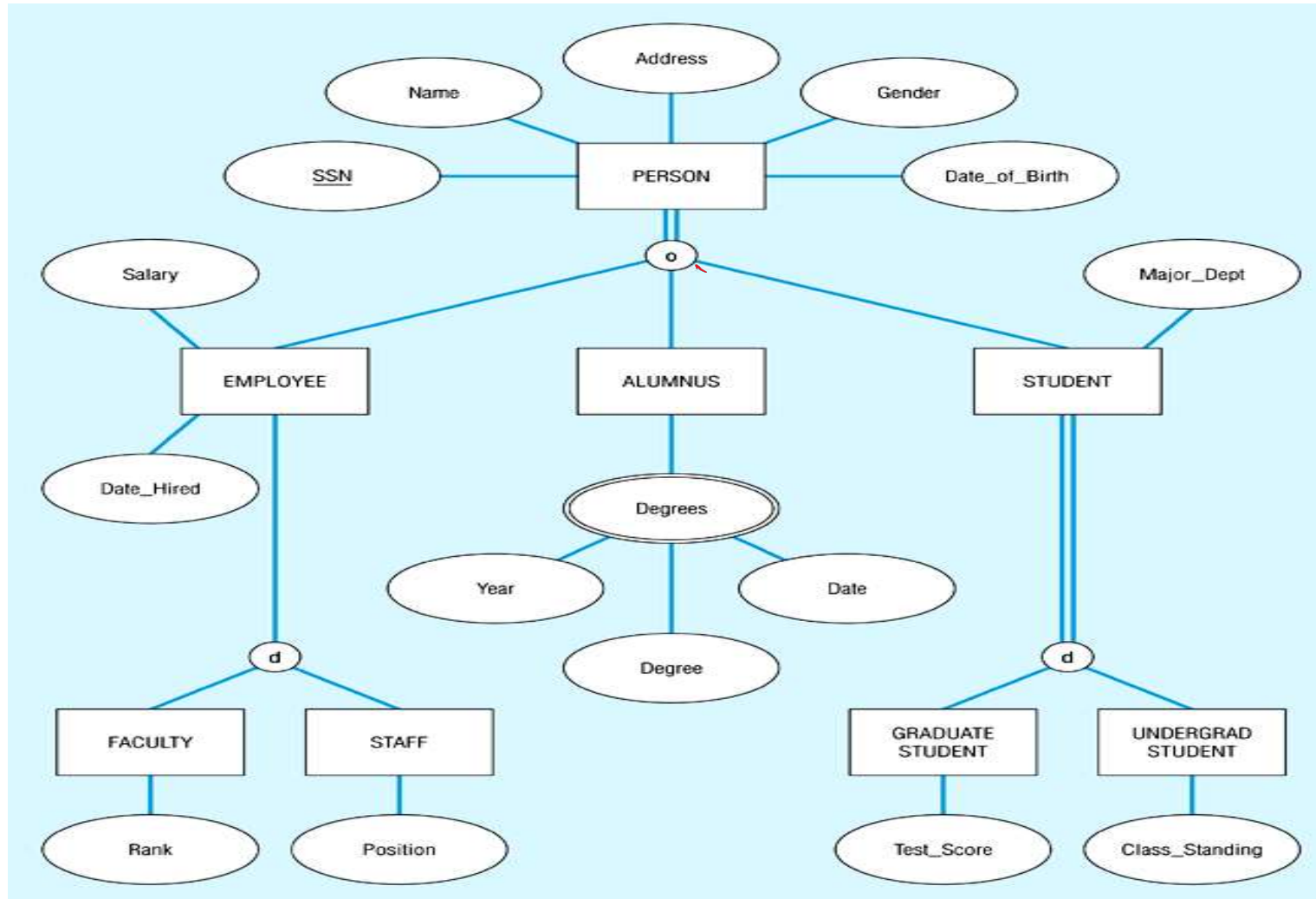
Introducing a subtype discriminator (*disjoint* rule)





Person can be employee or student -> overlapping rule

Example of supertype/subtype hierarchy



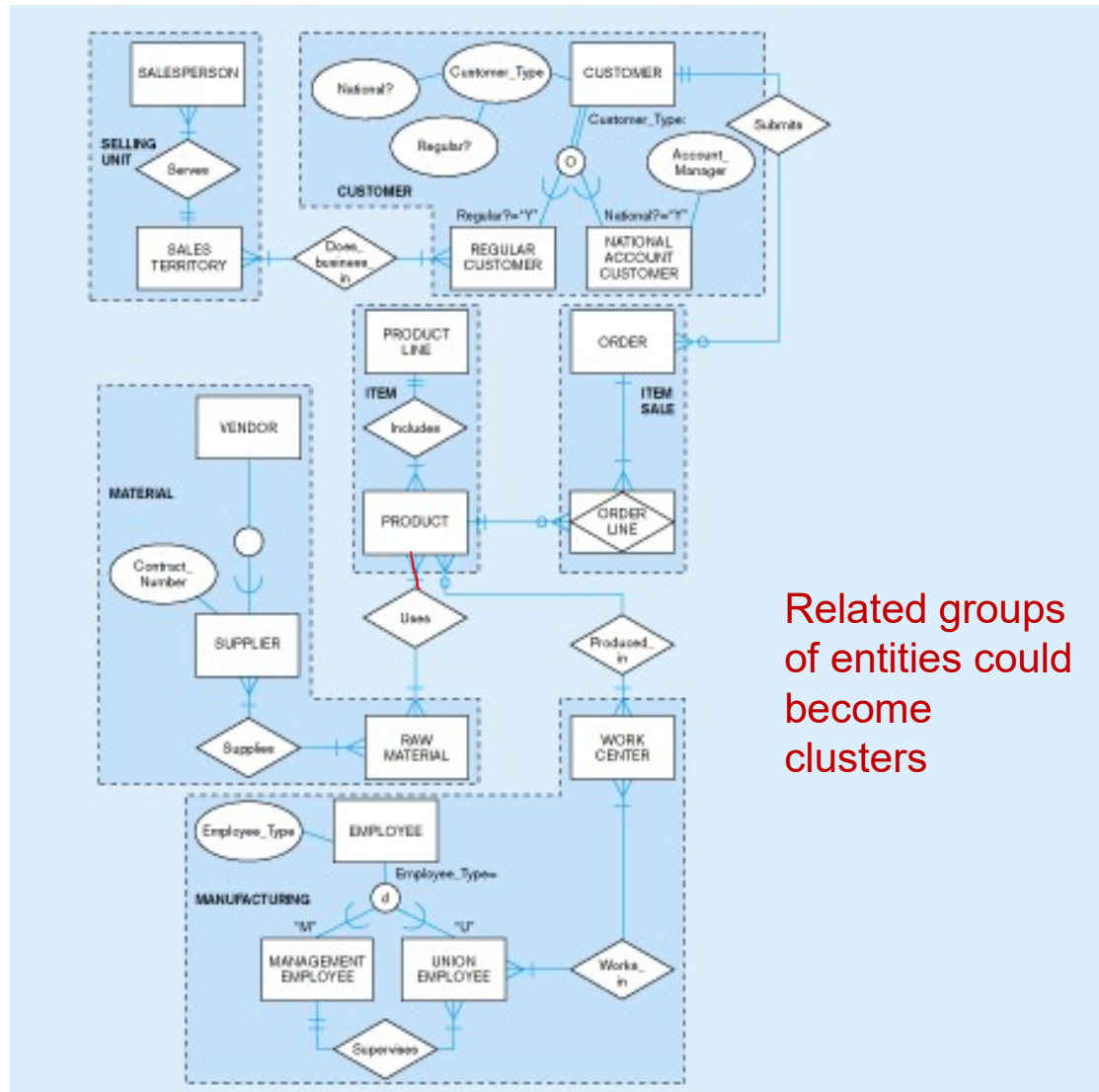
Entity Clusters

- EER diagrams are difficult to read when there are too many entities and relationships
- Solution: group entities and relationships into ***entity clusters***
- **Entity cluster:** set of one or more entity types and associated relationships grouped into a single abstract entity type

The reasons for entity clustering

- Complex enterprise-wide E-R diagram.
- Ability to have a hierarchical decomposition of data model.
- Desire to focus part of the model on an area of interest to some community of users.
- Ability to create several different entity clusters each with a different focus.

Possible entity clusters for Pine Valley Furniture



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